



Diabetic Foot

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Definition

Infection, ulceration or destruction of deep tissues associated with neurological abnormalities & various degrees of peripheral vascular diseases in the lower limb.

based on WHO definition



Objectives

- Examine the **prevalence** of diabetic foot complications and its impact on the patient as well as the economic impact on the healthcare system.
- Describe the **Comprehensive Diabetic Foot Exam (CDFE)** and review abbreviated foot exams to identify “at risk” feet.
- Understand the **pathogenesis** of diabetic foot ulcerations (DFU’s).
- Examine **standards of care** in regards to diabetic foot.
- Define **preventative strategies** to reduce the risk of diabetic foot ulcerations (DFU’s) and amputations.

Diabetic Foot Statistics

- Diabetic foot ulcerations are one of the most common complications associated w/ diabetes with a **global** annual incidence of **6.3%**.
- The **lifetime** incidence of foot ulcers in diabetic patients is **19-34%**.
- More than **50%** of diabetic ulcers become **infected** and **20%** of those w/ moderate-severe infection result in **amputation**.
- Nearly 85% of diabetes-related amputations are preceded by an ulceration.
- **Regular foot exams can reduce amputation rates 45-85%.**
- Annual diabetes care costs \$176B, 1/3 of which was related to lower extremity care.

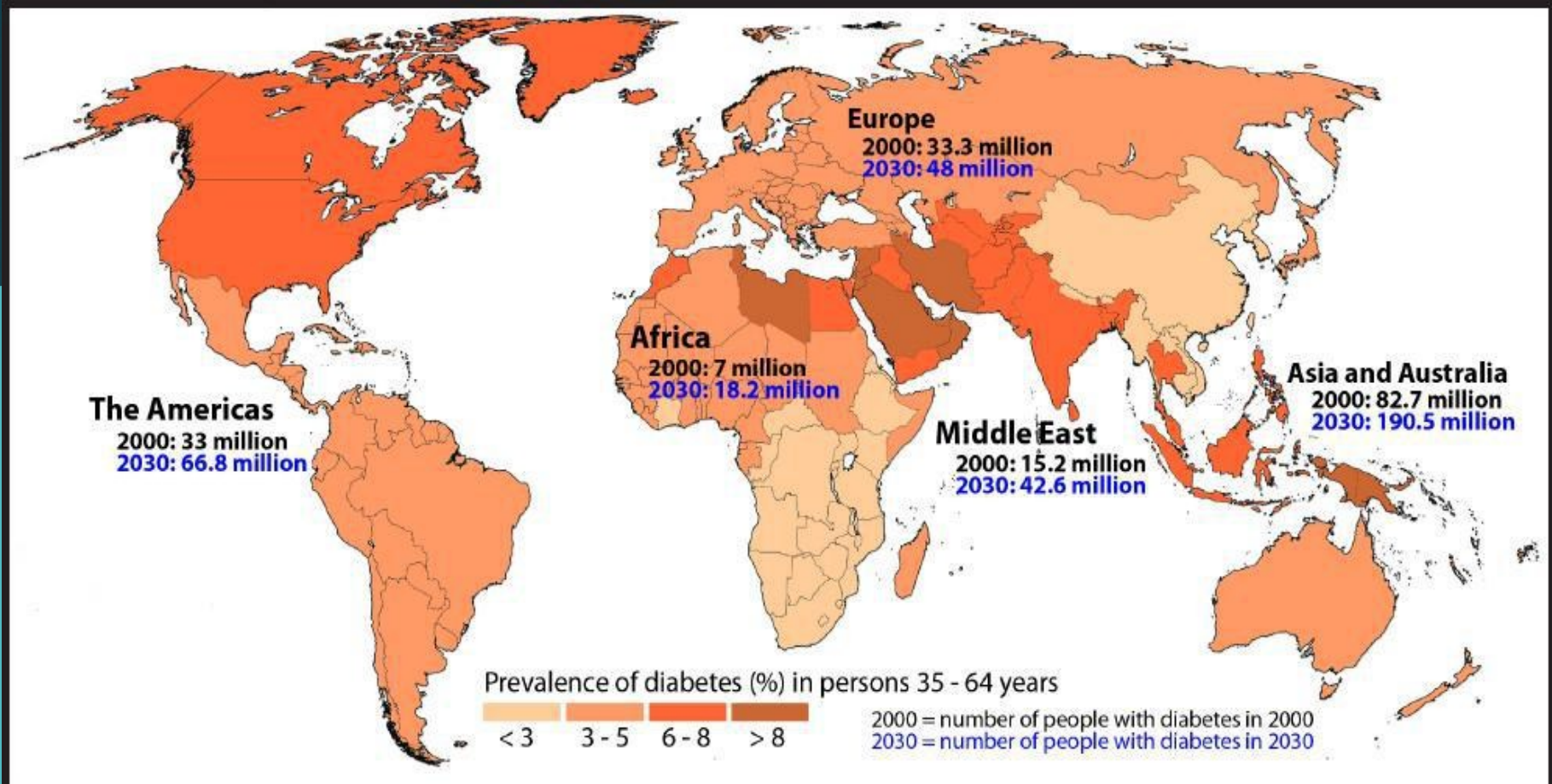
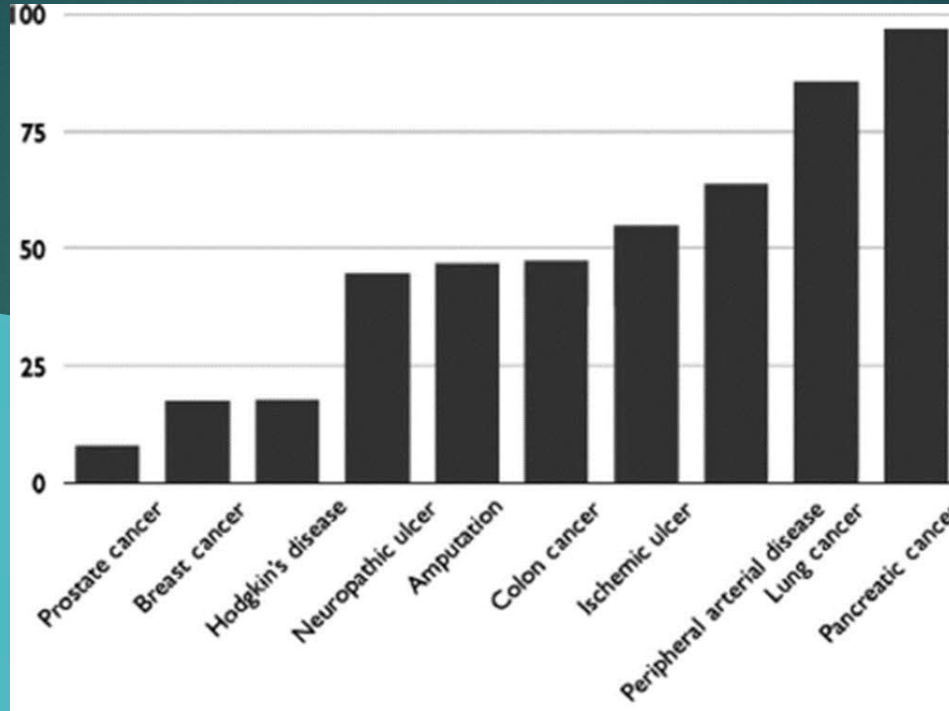


Figure 1 World map showing diabetes prevalence as percent of population (colour scale), and absolute morbidity for the years 2000 and 2030 (projected). There are geographical, and socioeconomic trends. (King et al., 1998).

In Saudi Arabia

- According to WHO Saudi Arabia is **ranked 7th** for rate of diabetes in the world and 2nd highest in middle east and pattern of diabetes is increasing.
- It is estimated that annually 325 amputations are likely to be performed in Jeddah compared to 741 in Riyadh and 3970 for the whole kingdom. This means an incidence rate of **2.6 per 10000 people at risk.**



5 year mortality rates associated with diabetic foot

Comprehensive Diabetic Foot Exam (CDFE)

Inside-out approach

- **Shoe-gear**

- Are the shoes wide & deep enough to accommodate the feet/deformities;
- shoes should have a non-constricting toe-box.
- Do the shoes show excessive wear?
- Are the shoes too short (hint, pull the insoles out and look @ the imprint of the longest toe-there should be a finger length of space to the end of the insole).

- **Socks**

- Are they present? Are they worn out? Are they too constricting?

- **Insoles**

- Frequently worn out, typically plantar metatarsal head region and toes, thus resulting in overload of pressure and frictional forces @ these locations.
- Sometimes insoles completely absent.

CDFE - Dermatological assessment

- Xerosis
- Maceration
- Blisters
- Tinea pedis
- Interdigital pathology
- Nail pathology
- Callus(es)
- Pre-ulcerative lesion(s)
- Ulceration(s)

CDFE - Neurological assessment

- **Loss of Protective Sensation (LOPS)** - 10g Semmes-Weinstein monofilament.
 - LOPS is a high risk factor for ulceration.
- Vibratory perception – 128 Hz tuning fork or Electronic tuning fork.
- Achilles reflex.

Diagnostic tests for Diabetic Peripheral Neuropathy include:



Vibration perception
tested with tuning fork

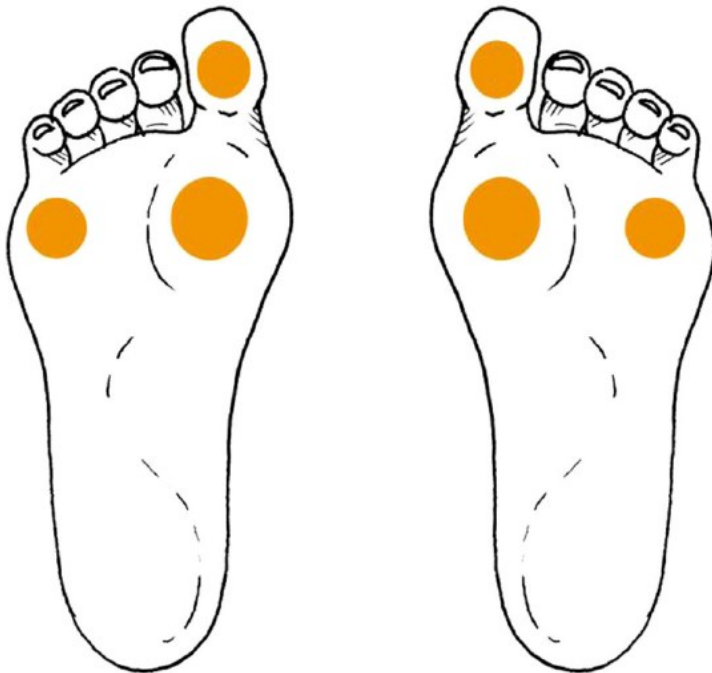


Monofilament
screening test



Nerve conduction
velocity
measurements

Screening for Protective Sensation Using The 10 gram Monofilament

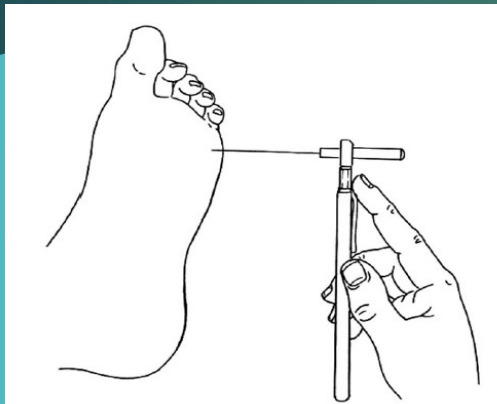


How to perform the sensory examination:

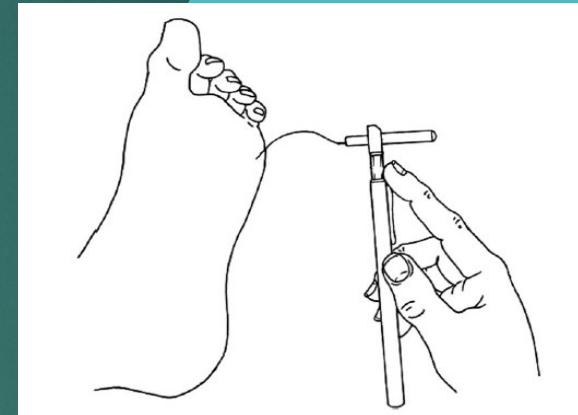
- Conduct in a quiet and relaxed setting.
- Begin by applying the monofilament to the hands, elbow or forehead so that patient what to expect.
- Ensure that the patient can not see whether or where the monofilament is being applied.
- Test the three sites on both feet shown in the figure.

Screening for Protective Sensation Using The 10 gram Monofilament

Apply the monofilament
perpendicular to the skin surface



Apply sufficient force to cause the
filament to bend or buckle



How to Apply the monofilament:

- Repeat the application twice at the same site, but alternate the application with at least one 'mock' application in which no filament is applied (total three questions per site).
- Protective sensation is present at each site if the patient correctly answers two out of three applications. Incorrect answers – the patient is then considered to lack protective sensation and is at risk of foot ulceration.

CDFE - Vascular assessment

- **Pedal pulses:** Dorsalis pedis, posterior tibial, perforating peroneal
- **Color:** Rubor or cyanosis.
- Capillary refill time (CFT).
- Peripheral edema.
- Temperature comparison between feet.
- **Toe pressures** (TBI is more useful than ABI).

CDFE - Musculoskeletal assessment

- **Pedal deformities** - Bunions, hammertoes, bone spurs, plantar-flexed metatarsals, pes cavus foot type, intrinsic minus foot.
- **Biomechanical abnormalities** - Hallux limitus, Achilles/gastro equinus, over-pronation.
- **Charcot neuropathic osteoarthropathy.**
 - Neuropathy is the key factor; typical deformity is plantar midfoot osseous prominence or collapse, “rocker-bottom appearance.”
 - Erythema/edema/warmth commonly present, if no open wound then most likely acute Charcot.



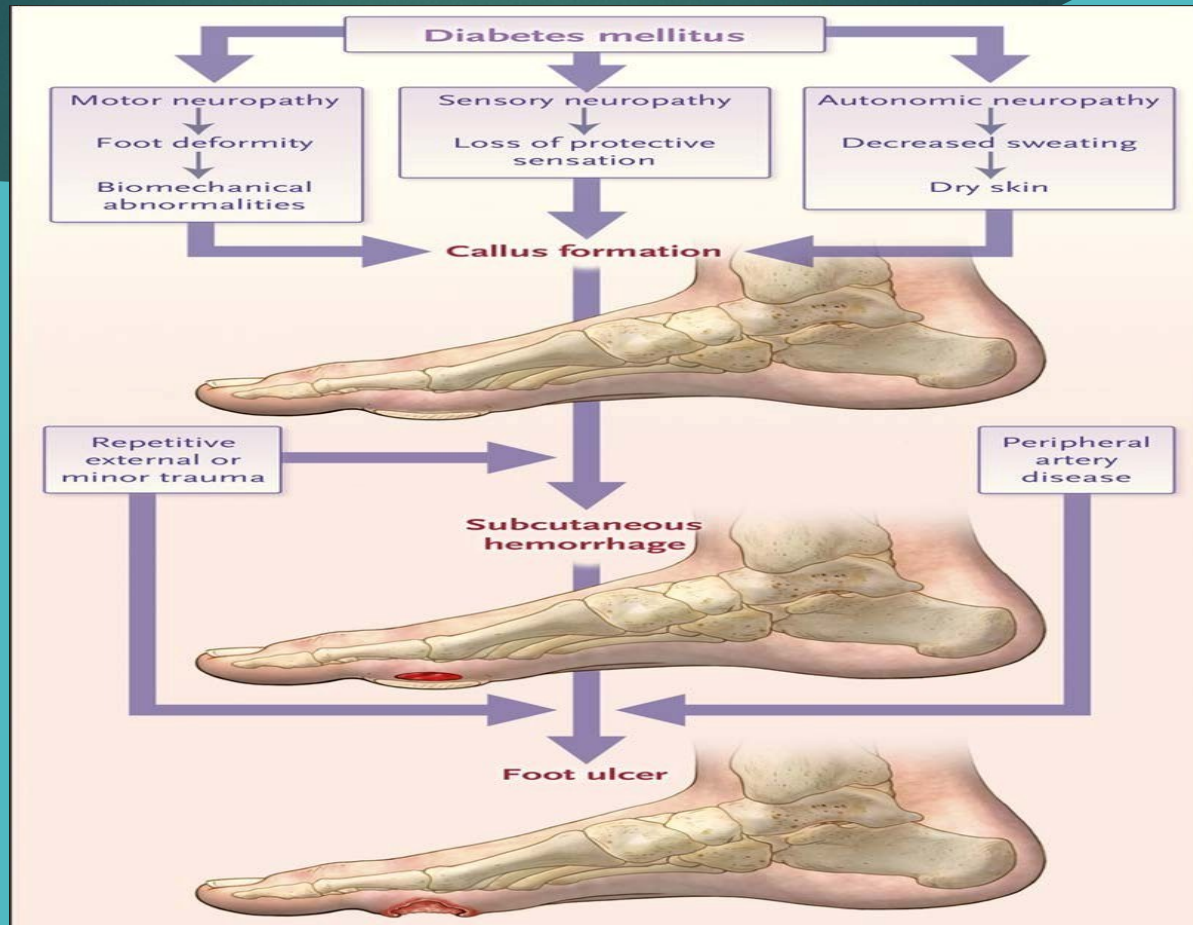
Key Elements of the Lower Extremity Physical Examination

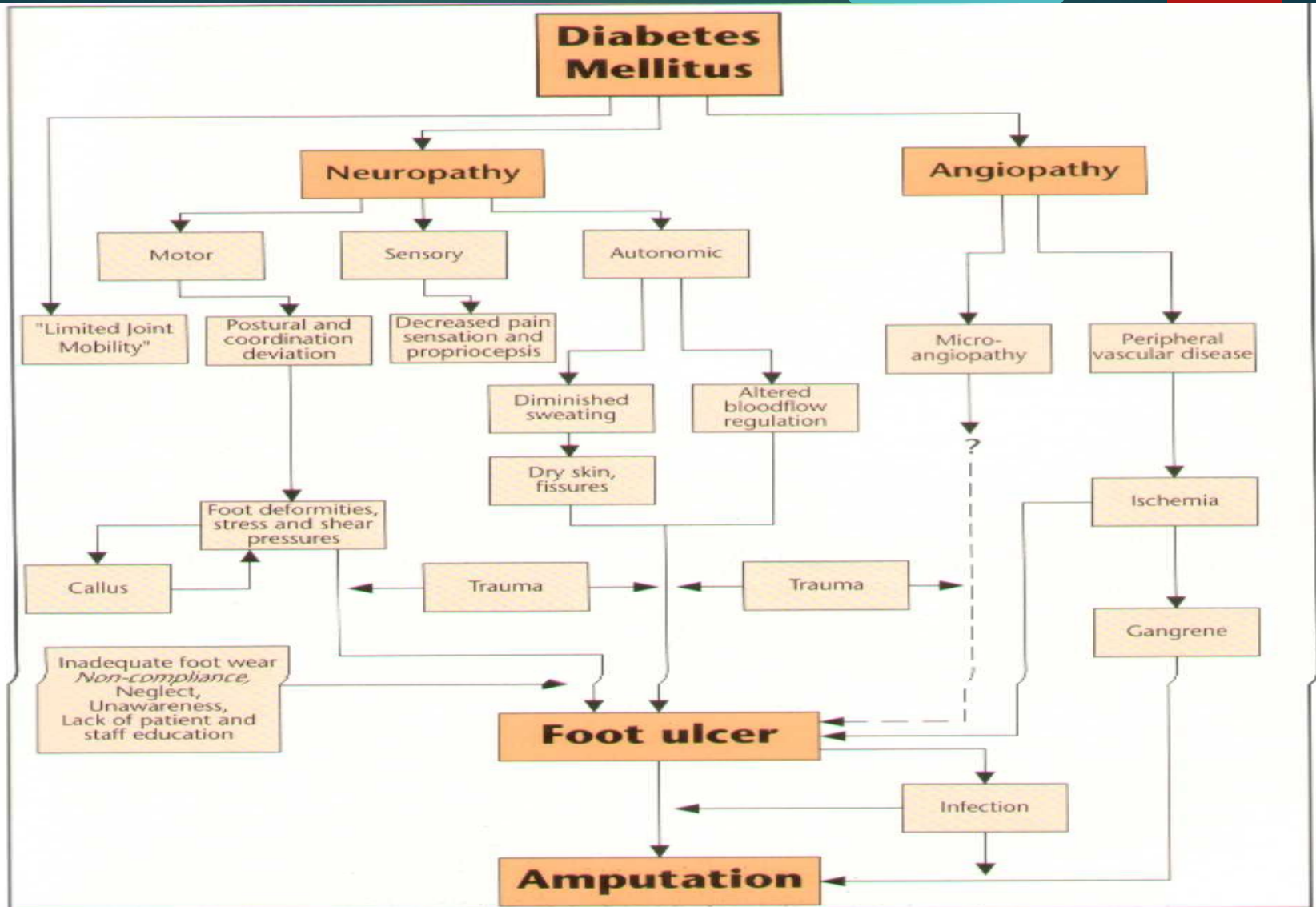
Element	Parameter
Inspection	• Gait • Foot morphology (Charcot arthropathy, bony prominences) • Toe morphology (clawtoe, hammertoe, number of toes) • Skin: blisters, abrasions, calluses, subkeratotic hematomas or hemorrhage, ulcers, absence of hair, toe nail problems, edema, abnormal color • Status of nails • Foot hygiene (cleanliness, tinea pedis)
Palpation	• Pedal pulses • Temperature (increased or decreased warmth)
Protective sensation	• Sensation to 10 gram monofilament
Footwear	• Exterior: signs of wear, penetrating objects • Interior: signs of wear, orthotics, foreign bodies

Pathogenesis of ulceration

- The most common pathway to ulceration: **Neuropathy** (key precipitating factor) → **Pedal deformity** → **Trauma** (typically repetitive microtrauma: pressure, friction, and shearing forces on soft tissue).
- Other risk factors
 - Previous ulcer/amputation.
 - PVD/PAD.
 - Poor glycemic control.
 - Visual impairment.
 - Nephropathy.
 - Smoking.

Pathway to diabetic foot ulceration





Pathways to diabetic foot ulceration

International Working Group on the Diabetic Foot (IWGDF)

Cornerstones of Prevention

- Identification of the at-risk foot.
- Regular inspection and examination of the at-risk foot.
- Education of patient, family, and healthcare providers.
- Routine wearing of appropriate footwear.
- Treatment of pre-ulcerative signs

IWGDF 2015 Risk Classification

Category	Characteristics	Frequency
0	No peripheral neuropathy	Once a year
1	Peripheral neuropathy	Once every 6 months
2	Peripheral neuropathy + PAD &/or foot deformity	Once every 3-6 months
3	Peripheral neuropathy & history of ulceration or amputation	Once every 1-3 months

ADA Standards of Medical Care in Diabetes

2017 - Footcare Recommendations

- Perform a comprehensive foot exam @ least annually to identify risk factors for ulceration and amputation.
- **All patients with diabetes should have their feet inspected @ every visit.**
- Obtain history of prior ulceration, amputation, Charcot, vascular surgery, smoking status, retinopathy & nephropathy, and assess current symptoms of neuropathy (numbness, burning) and vasculopathy (claudication).
- Exam should consist of Derm, Neuro, Vascular, and Musculoskeletal.
 - Specific to Neuro, 10g SWMF and another (vibratory).

Prevention Recommendations

- Comprehensive Diabetic Foot Examination (CDFE).
- Use risk classification to make appropriate referrals and frequency of visits/exams.
- At the very least, a visual foot inspection should be performed @ every physician visit.
- Minimal exam (visual inspection + LOPS screening) can provide a generalized risk level, referral may then be made for the CDFE.
- Utilization of diabetic shoes/insoles to prevent ulcerations and subsequently amputations.

Educate People with Diabetes on Proper Foot Care – The “DO’s”

DO ...

Check your feet **every day** for cuts, cracks, bruises, blisters, sores, infections, unusual markings

Use a **mirror** to see the bottom of your feet if you can not lift them up

Check the **colour** of your legs & feet – seek help if there is swelling, warmth or redness

Wash and dry your feet every day, especially between the toes

Apply a good **skin lotion every day** on your heels and soles. Wipe off excess

Change your socks every day

Trim your **nails straight across**

Clean a cut or scratch with **mild soap and water** and **cover** with dry dressing

Wear good supportive shoes or professionally fitted shoes with low heels (under 5cm)

Buy shoes in the late afternoon since your feet swell by then

Avoid extreme cold and heat (including the sun)

See a foot care specialist if you need advice or treatment

Educate People with Diabetes on Proper Foot Care – The “DON’ Ts”

DO NOT ...

Cut your own **corns** or **callouses**, nor treat your own **in-growing toenails**. See your doctor or foot care specialist

Use over-the-counter medications to treat corns and warts

Apply heat with a hot water bottle or electric blanket – may cause burns unknowingly

Soak your feet or use **lotion between your toes**

Take very **hot baths**

Walk **barefoot** inside or outside

Wear **tight socks, elastics or knee highs**

Wear over-the-counter insoles – may cause blisters if not right for your feet

Sit for long periods of time

Smoke

Management of Diabetic Neuropathy

- Look for it!
- Tight glycaemic control
- Painful
 - medication
 - referral to neurologist
- Intensive podiatry/orthotic input
- Pressure Off-Loading

Pressure Off-Loading

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Total Contact Cast



Diabetic Air Walker

Diabetic Foot Ulcer Treatment

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- ▶ Microbiological control
- ▶ Wound control
- ▶ Vascular control
- ▶ Mechanical control
- ▶ Metabolic control
- ▶ Educational control

Amputation in Diabetic Patient

- ▶ Increased minor/major amputation increased the no. of deformed feet
- ▶ Minor amputation is needed :
 - ▶ Gangrene
 - ▶ As part of debridement
 - ▶ For correction of foot deformities
- ▶ Minor amputation doesn't significantly compromise walking ability

Major Amputation

- ▶ ↑ Risk of loss walking ability
- ▶ ↑ Mortality
- ▶ ↑ Risk of contra-lateral amputation
- ▶ Strict indication
- ▶ Careful choice of the level

Management - Medical

↓ Progression of disease

- Stop smoking
- Rx predisposing factors
- Foot care

Management - Medical

↓ progression of disease

↑ **blood flow**

- Exercises
- Drugs
 - Antiplatelet :Aspirin / ticlopidine / clopidogrel
 - Dipyridamole (Persantin)
 - Pentoxiphylline (Trental)
 - Cilostazol (Pletoz)

Management - medical

↓ progression of disease

↑ blood flow

Relief of pain

- NSAIDS: check renal functions
- Opiates: cause constipation
- Epidural analgesia
- Antibiotic
- Drainage abscess

Management - intervention

Endovascular

- Balloon angioplasty +/- Stent

Surgery

- Bypass
 - Anatomical
 - Aorto-bifemoral
 - Ileo-femoral
 - Femoro-popliteal
 - Extra-anatomical
 - Axillo-bifemoral
 - Femoro-femoral

Management Algorithm for the Diabetic Foot Lesion

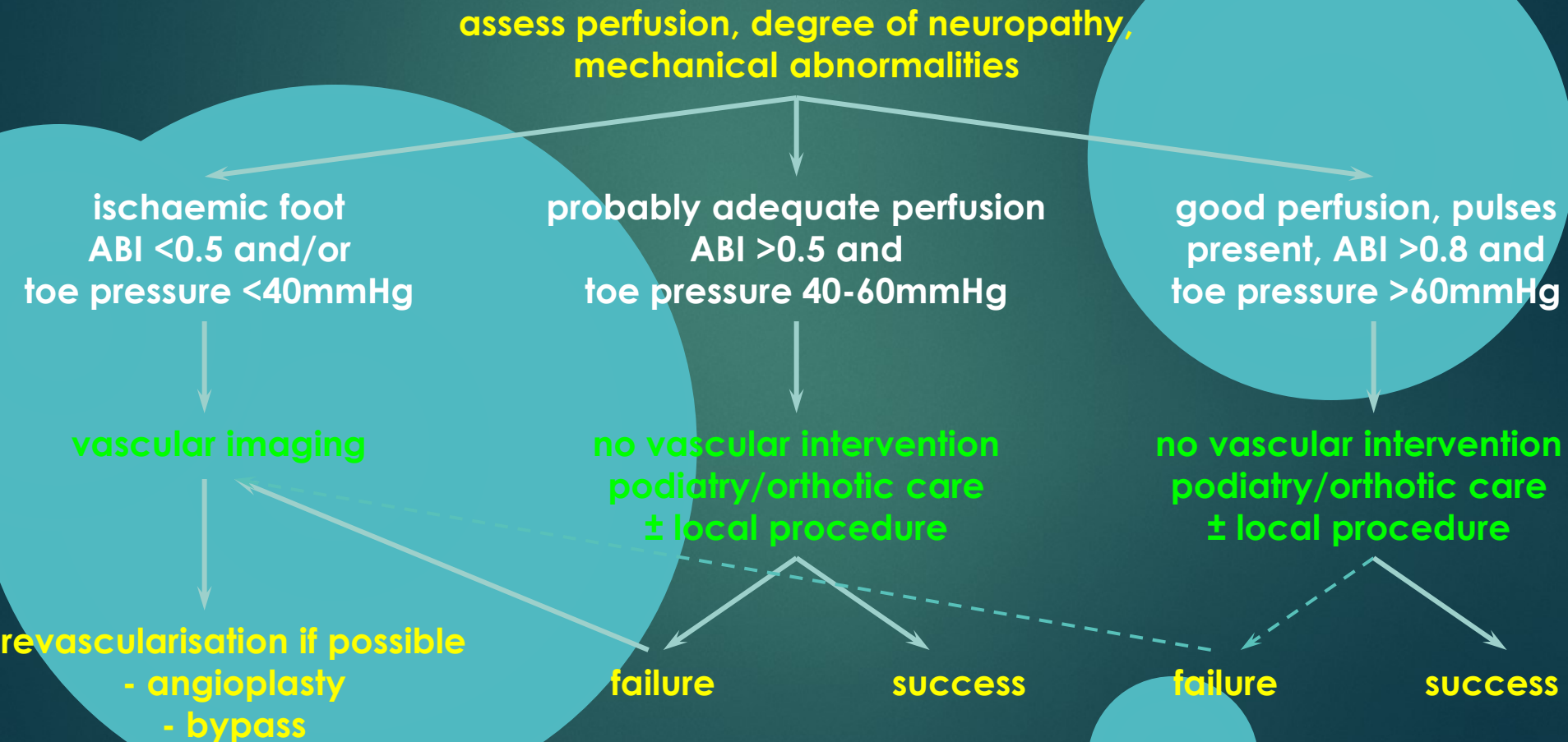
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pus/wet gangrene
in foot present

↓
drain
debride

dry gangrene/
ulceration ±cellulitis/
osteomyelitis

↘ ↙
assess perfusion, degree of neuropathy,
mechanical abnormalities



NB: less likely outcome ----->

The End!